Answer to problem no. 3-8

Dilution factor, $DF = \frac{300}{6} = 50$

Given,

$DO_0 = 8.6\ mg/L$

$DO_5 = 5.4\ mg/L$

$\therefore BOD_5 = 50(8.6-5.4)\ mg/L$

$= 160\ mg/L$

Ans: 160 mg/L

Answer to problem no. 3-9

Given,

$BOD_5 = 40.0\ mg/L$

$DO_5 = 2.74\ mg/L$

Size of sample = 40 mL

$\therefore$ Dilution factor, $DF = \frac{300}{40} = 7.5$

Now,

$BOD_5 = DF(DO_0 - DO_5)$

$\Rightarrow 40 = 7.5(DO_0 - 2.74)$

$\Rightarrow DO_0 - 2.74 = 5.33$

$\Rightarrow DO_0 = 8.74\ mg/L$

Ans: 8.74 mg/L

Answer to problem no. 3-10:

We know that,

$$V_1S_1 = V_2S_2$$

$$\Rightarrow 300 \times 2 = 400 \times S_2 V_2$$

$$\Rightarrow V_2 = 1.5\,mL$$

$\therefore$ Percentage of sample $= \frac{1.5}{300} \times 100\%$

$= 0.5\%$ of the mixture.

Ans: 0.5% of the mixture.

Answer to problem no. 3-11:

Given,

$DF = 10$

$\therefore$ Waste sample used $= \frac{300}{10} = 30\,mL$

$\therefore$ Seeded sample $= (300 - 30) = 270\,mL$

Seed control $= 300\,mL$

$DO_0 = 8.55\,mg/L$

$DO_5 = 2.4\,mg/L$

$B_0 = 8.75\,mg/L$

$B_5 = 8.53\,mg/L$

$f = \frac{270}{300} = 0.9$

$\therefore BOD_5 = 10[(8.55 - 2.40) - 0.9(8.75 - 8.53)]$

$= 59.5\,mg/L$

Ans: 59.5 mg/L

Answer to problem no. 3-12:

Using the data from the previous problem,

$$BOD_4 = 10[(8.55 - 2.75) - 0.9(8.75 - 8.57)]$$

$$= 56.38 \text{ mg/L}$$

Ans: 56.38 mg/L

$$BOD_6 = 10[(8.55 - 2.10) - 0.9(8.75 - 8.49)]$$

$$= 62.16 \text{ mg/L}$$

Ans: 62.16 mg/L

Answer to problem no. 3-13:

Given,

$y_s = 210 \text{ mg/L}$

$k = 0.23 d^{-1}$

Now, $y_s = L(1 - e^{-kt})$

$\Rightarrow 210 = L(1 - e^{-0.23 \times 5})$

$\Rightarrow L = 307.3 \text{ mg/L}$

Ans: 307.3 mg/L

P.T.O

At 30°C,

$$k_{30} = k_{20}\,\theta^{T-20}$$
$$= 0.23 \times 1.047^{30-20}$$
$$= 0.36\ day^{-1}$$

$\therefore$ 10 day demand, $y_{10} = 307.3\,(1 - e^{-0.36 \times 10})$

$= 298.9\ mg/L$

Ans: 298.9 mg/L

Answer to question no. 3-14:

For the first sample,

$$250 = L\,(1 - e^{-0.25 \times 5})$$

$\Rightarrow L = 350.39\ mg/L$

Ans: 350.39 mg/L

For second sample,

$$250 = L\,(1 - e^{-0.35 \times 5})$$

$\Rightarrow L = 302.58\ mg/L$ Ans: 302.58 mg/L

For the third sample,

$$250 = L\,(1 - e^{-0.46 \times 5})$$

$\Rightarrow L = 277.86\ mg/L$

Ans: 277.86 mg/L

Answer to problem no. 3-15:

For 2 days,

$$125 = L(1 - e^{-2k})$$

$$\Rightarrow L = \frac{125}{1 - e^{-2k}} \quad \text{---- (i)}$$

For 8 days,

$$225 = L(1 - e^{-8k})$$

$$\Rightarrow L = \frac{225}{1 - e^{-8k}} \quad \text{---- (ii)}$$

Now, equating equation (i) & (ii),

$$\frac{125}{1 - e^{-2k}} = \frac{225}{1 - e^{-8k}}$$

$$\Rightarrow 125 - 125e^{-8k} = 225 - 225e^{-2k}$$

$$\Rightarrow 225e^{-2k} - 125e^{-8k} = 125 = 100$$

$$\Rightarrow 225e^{-2k} - 125e^{-8k} - 100 = 0$$

Using trial and error method,

for $k = 0.3754$, the equation tends to 0.

From (i),

$$L = \frac{125}{1 - e^{-2 \times 0.3754}} = 236.7 \text{ mg/L}$$

$\therefore$ 5 day BOD, $BOD_5 = 236.7(1 - e^{-0.3754 \times 5})$

$$= 200.47 \text{ mg/L}$$

Ans: 200.47 mg/L